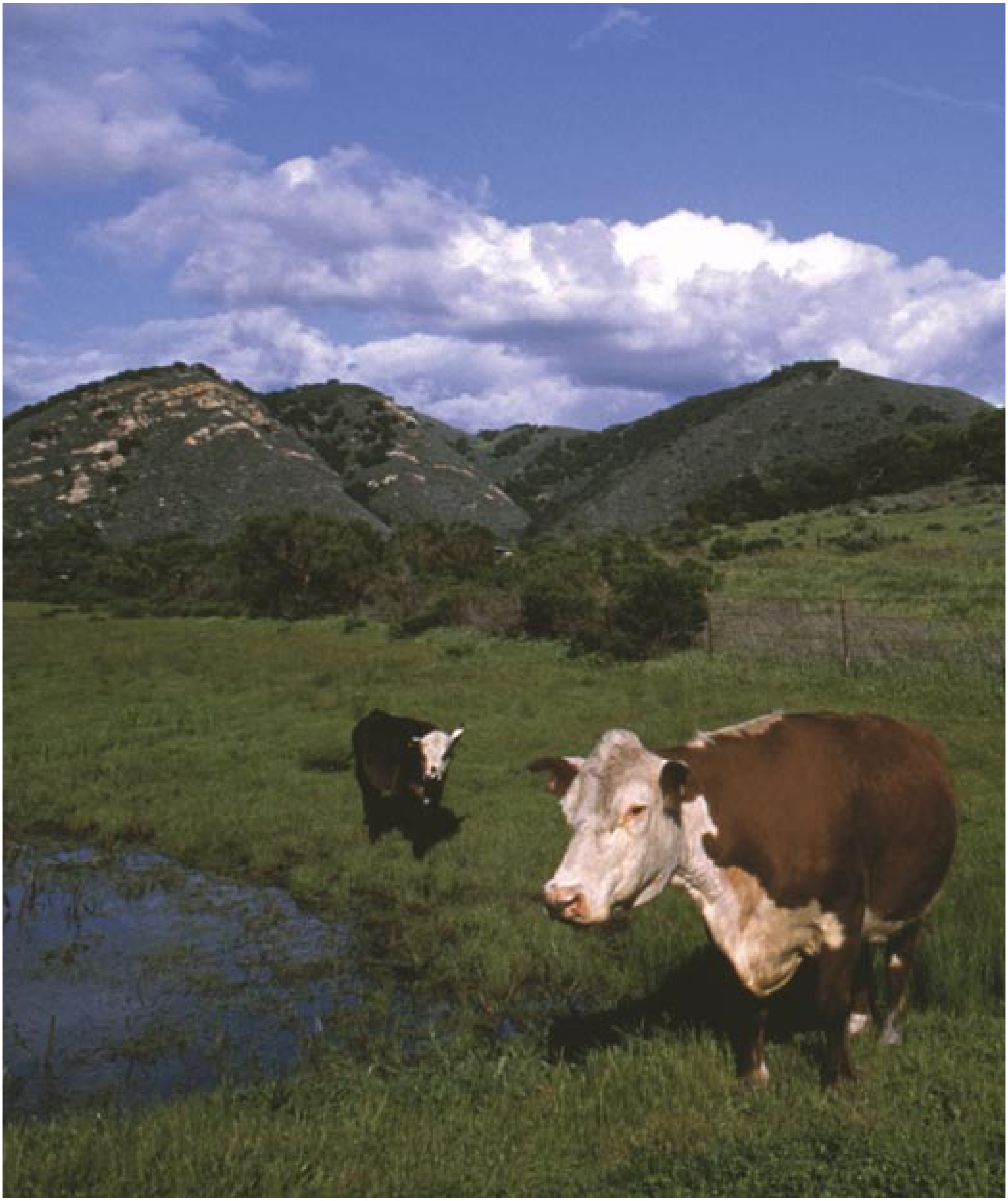
Volume 2

Chapter 26 Other Resource Management Strategies



Some resource management strategies are limited in their capacity to strategically address long-term regional water planning needs, although they may meet one or more water management objectives. Dry-land farming relies on rainfall alone to sustain the land's agricultural use. (DWR photo)

Chapter 26 *Other Resource Management Strategies*

This narrative highlights a variety of water management strategies that can potentially generate benefits that meet one or more water management objectives, such as water supply augmentation or water quality enhancements. However, these management strategies are currently limited in their capacity to strategically address long-term regional water planning needs. In some cases, such as Dewvaporation, the strategy involves emerging technologies that will require more research and development. In other cases, such as Crop Idling and Irrigated Land Retirement, they involve voluntary and often temporary tradeoffs from one sector of use to another (i.e., agricultural to urban) that will likely be unpredictable and limited in scope over the time horizon of this California Water Plan Update. Finally, implementation of strategies such as Rainfed Agriculture will have limited applicability in California due to the variability and uncertainty of precipitation patterns within the state from year to year.

A list of the strategies considered in this narrative:[1]

- Crop idling for water transfers
- Dewvaporation or atmospheric pressure desalination
- Fog collection
- Irrigated land retirement
- Rainfed agriculture
- Waterbag transport/storage technology

Crop Idling for Water Transfers

Crop idling is removal of lands from irrigation with the aim of returning the lands to irrigation at a later time. Crop idling for water transfers is done to make water available for transfer (See Volume 2, Chapter 23 for more information on water transfers). Crop idling may be done for a certain time or can be episodic. Land retirement for water transfer and for solving drainage and drainage-related problems is discussed in land retirement strategy later in this section. Crop idling, with the intent of soil and crop management and for soil and crop sustainability and productivity, is discussed in the agricultural lands stewardship strategy.

Crop Idling Programs

Westlands Water District Lease Back Program – The WWD has implemented a lease-back land fallowing program for about 30,000 acres. These lands are expected to be returned to irrigation if the U.S. Bureau of Reclamation provides drainage service to the lands.

Palo Verde Irrigation District Land Management, Crop Rotation, and Water Supply Program – This crop idling program helps provide more reliable water supply for urban Southern California, while helping Palo Verde Irrigation District farmers and local economy. PVID's program includes crop idling of predetermined duration. The principles of the proposed agreement followed a pilot program from 1992 to 1994. Under the pilot program, MWD compensated farmers for setting aside a portion of the land for two years, in return for the water that otherwise would have been used to grow hay, cotton, or other field crops. Program participants reported spending 90 percent of the money on farm-related investments, purchases, and debt repayment.

[1] Note that the quantity and specificity of information varies between strategies. This is solely due to the amount of information available to staff and does not imply any relative efficacy of the strategies.

Wetlands Reserve Program – The objective of the Wetlands Reserve Program (WRP) is to preserve and enhance the nation's wetlands. Under the WRP, willing farmers sell long-term agricultural production easements to the federal government. The WRP may result in improving quality of drainage waters from irrigated lands and thus benefits agriculture.

Summer Alfalfa Dry-down Research Program – This is an episodic event. Alfalfa summer dry-down is the practice of cutting off irrigation for one or two summer months and then reapplying water again in the fall when temperatures are cooler. The water saved during this period can be transferred to other uses. The yield and quality of the summer cuttings is low. Early alfalfa production in the desert regions used alfalfa summer dry-down to control weeds and conserve water. This program is currently under research and development. Alfalfa summer dry-down offers a unique tool for drought water management for several reasons. The program has potentially large water savings; 1 acre-foot per acre or 0.5 million acre-feet to 1 million acre-feet statewide. Net water savings can be easily verified. Water storage and transfer decisions can be made as late as June. Yield is generally reduced by only 20 to 40 percent, which diminishes the impact of crop idling on local communities. Research on alfalfa summer dry-down over the past 15 years has had mixed results with crop loss being the major limitation.

Potential Benefits

Crop idling could enhance water supply reliability by making water available for redistribution, enhance water quality, and protect and restore fish and wildlife. The water made available from crop idling depends on how long irrigation is interrupted. Palo Verde Irrigation District Land Management Program is expected to have an estimated annual water supply of 25,000 acre-feet to 111,000 acre-feet for transfer to MWD.

The crop idling program helps the farming community as well as urban areas, infusing money into the local economy, while increasing the reliability of water supplies for urban consumers. Avoided costs of new water supply should also be considered in the costs and benefit analysis of crop idling. Payments to farmers would provide stable income that can be used on farm-related investments, purchases and debt repayment and for local community improvement programs.

Potential Costs

Costs include loss of crop productivity and the annual cost of managing the lands to avoid negative impacts. Additional costs can include program development, administration, and mitigation of local and regional socioeconomic impacts.

Major Issues Facing Crop Idling

Socioeconomic Impacts

Loss of agricultural productivity and loss of revenue to the local communities and regional and statewide socioeconomic impacts are issues of concern. Crop idling can significantly change the local population's way of life. It can cause loss of local tax base, community businesses and farm related jobs locally and regionally. The third-party impacts can be significant, especially when crop idling is concentrated in areas where the communities provide labor and other services. If significant amount of land is idled it can also have a statewide impact on the economies, food production, and food security.

Environmental Impacts

Land use changes can impact neighboring land and its productivity. It can cause introduction of new wildlife species, weeds, pests, illegal dumping of refuse. It can affect the disposition of water and water rights issues and alter resources such as soils, groundwater, surface waters, cultural resources, recreation, biological including human health, dust and air quality. In addition, communities that serve agricultural activities inherently have high percentage of low income and disadvantaged groups that can be affected by the crop idling. Cumulative effects of short- and long-term crop-idling could have impacts on habitat, water quality, and wildlife caused by changing the location, timing, and quantity of applied water, and reducing agricultural returns flows to wildlife areas. For example, rice growing areas could have significant secondary benefits as wildlife habitat. Crop idling in these areas could either harm or benefit different species depending on implementation.

Recommendations to Encourage Crop Idling Programs to Benefit Water Management Strategy

1. The agency or entity leading the crop idling program must begin early consultation with other agencies and develop the necessary coordination structure to satisfy the agency policy requirements and avoid conflicts.
2. Study local community impacts and other third-party impacts and develop and implement the necessary actions for maintaining the economic stability of local communities and mitigation of socioeconomic impacts.

Dewvaporation or Atmospheric Pressure Desalination

Dewvaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall. The energy needed for evaporation is supplied by the energy released from dew formation. Heat sources can be combustible fuel, solar or waste heat. The tower unit is built of thin plastic films to avoid corrosion and to minimize equipment costs. Towers are relatively inexpensive since they operate at atmospheric pressure.

Dewvaporation in California

The technology of dewvaporation is still being developed. Final demonstration project towers have been built and operated at Arizona State University (ASU) laboratories. The Salt River Project and the ASU Office of Technology Collaborations and Licensing are sponsoring the dewvaporation pilot plant program as an extension of grassroots support by the U.S. Bureau of Reclamation.

Potential Benefits

Dewvaporation can provide small amounts of water in remote locations. The basic laboratory test unit produces to 150 gallons per day. Eight of these units form a 1,000-gallons-per-day demonstration pilot plant of the dewvaporation process.

Areas such as Yuma, Arizona, and the desert regions of California could reclaim salt water at relatively low cost by taking advantage of their dry climates.

Potential Costs

The capital cost of 1,000 gallon per day desalination plant can range between $1,100 and $2,000. Operating costs range from $0.80 to $3.70 per 1,000 gallons distillate, or about $260 to $1,200 per acre-foot, depending on fuel source, humidity levels and plant size.

Major Issues Facing Dewvaporation

1. Cost and affordability
2. Small scale
3. Concentrate disposal

Fog Collection

Precipitation enhancement also includes other methods, such as physical structures or nets to induce and collect precipitation.

Fog Collection in California

Precipitation enhancement in the form of fog collection has not been used in California as a management technique but does occur naturally with coastal vegetation; fog provides an important portion of summer moisture to our coastal redwoods.

Potential Benefits

There has been some interest in fog collection for domestic water supply in some of the dry areas of the world near the ocean where fog is frequent. Some experimental projects have been built in Chile, and have been considered in some parts of the Middle East and South Africa. The El Tofo project in Chile yielded about 10,600 liters per day from about 3,500 square meters of collection net, about 3 liters per day per square meter of net. Because of its relatively small production, fog collection is limited to producing domestic water where little other viable water sources are available.

Potential Costs

The lowest costs for fog collection in Chile, where labor is much less expensive than California, were about $1.40 per 1,000 liters, or about $1,750 per acre-foot.

Irrigated Land Retirement

Irrigated land retirement is the removal of farmland from irrigated agriculture. The permanent land retirement is perpetual cessation of irrigation of lands from agricultural production, which is done for water transfer or for solving drainage-related problems. (See Volume 2, Chapter 23 for more information on water transfers). Crop idling, or land fallowing, for crop management and for soil and crop sustainability and productivity is discussed in the agricultural lands stewardship strategy. Crop idling, with the intent of water transfer, is discussed in crop idling strategy.

Irrigated Land Retirement in California

Central Valley Project Improvement Act Land Retirement Program – The 1992 Central Valley Project Improvement Act authorized purchase from willing sellers, of agricultural land and associated water rights and other property interests which receive CVP water. The program is expected to retire about 100,000 acres of irrigated farmland.

The U.S. Bureau of Reclamation initiated the Land Retirement Demonstration Project. So far, this program has retired about 8,300 acres of land in the Westlands Water District and the Tulare Lake Basin.

CVPIA Land Retirement Program Applies to lands that:

- *Would improve water conservation or improve the quality of an irrigation district's agricultural drainage water*

  Or

- *Are no longer suitable for sustained agricultural production because of permanent damage resulting from severe agricultural drainage water management problems, groundwater withdrawals, or other causes*

Reclamation's Settlement Agreements – About 3,000 acres of drainage problem lands in WWD have been retired as a part of Britz vs. U.S. Bureau of Reclamation settlement. Also, 33,000 acres in the WWD over a three-year period are planned to be retired, Sumner-Peck vs. U.S. Bureau of Reclamation. These lands have been permanently retired and the associated water allocation is given to WWD under an agreement.

Potential Benefits

Land retirement could enhance water supply reliability by making water available for redistribution, enhance water quality, and protect and restore fish and wildlife resources, but it results in loss of agricultural lands. The total water made available by irrigated land retirement is potentially 2 to 3.5 acre-feet per year for each retired acre, assuming the lands are receiving their water allocation.

Permanent land retirement in problem drainage areas would improve water quality, specifically reducing the risk of selenium exposure to fish and wildlife. Permanent land retirement can reduce drainage volume annually by about 0.3-0.5 acre-feet per acre, reducing the costs associated with drainage disposal. Permanent retirement of lands also creates an opportunity to establish upland or other habitat for wildlife.

Potential Costs

Costs include price of lands and the annual cost of managing the lands to avoid environmental impacts. Additional costs may include program development, administration, and mitigation of local and regional socioeconomic impacts.

Major Issues Facing Land Retirement

Willing Participant — Land retirement is voluntary, and many farmers may lack the desire sell their land and abandon their way of life.

Growth Inducement of Land Retirement — Land retirement could result in urban growth when water from retired lands is made available to urban areas.

Socioeconomic Impacts — Loss of agricultural productivity and loss of revenue to the local communities and regional and statewide socioeconomic impacts are issues of concern. Land retirement can significantly change the local population's way of life. It can cause loss of local tax base, community businesses and farm related jobs locally and regionally. The third-party impacts can be significant, especially when land retirement is concentrated in areas where the communities provide labor and other services. If significant amount of land is retired it can also have a statewide impact on the economy, food production, and food security.

Environmental Impacts — Land use changes can impact neighboring land and its productivity. It can cause introduction of new wildlife species, weeds, pests, and illegal dumping of refuse. It can affect the water rights issues and alter resources such as soils, groundwater, surface waters, cultural resources, recreation, biological including human health, dust and air quality. In addition, communities that serve agricultural activities inherently have high percentage of low income and disadvantaged groups that can be affected by land retirement. Cumulative effects of land retirement could have impacts on habitat, water quality, and wildlife caused by changing the location, timing, and quantity of applied water, and reducing agricultural returns flows to wildlife areas. Land retirement could either harm or benefit different species depending on what the land use is changed to.

Recommendations to Facilitate Land Retirement Programs to Benefit Water Management

1. The agency or entity leading the land retirement program must begin early consultation with other interested agencies and develop the necessary coordination structure to satisfy the agency policy requirements and avoid conflicts.
2. The land purchase price has to be fair and costs associated with the mitigation of all impacts must be considered in developing the program. Land retirement programs must be voluntary.
3. Since alternative land use management scenarios may achieve similar objectives, alternatives to permanent retirement to achieve the same objectives should be considered in developing land retirement programs. Also, there is a need to assist local water agencies with using land retirement as appropriate for local conditions for State and local benefits.

This may include voluntary integration of land fallowing with conjunctive use and water exchange and transfers. When retiring lands, give the highest priority to lands with poor quality, low productivity, and high trace element contents.

4. The lead agency must evaluate the growth inducement impacts of the program and ensure that the urban area receiving the water made available by land retirement has exhausted means of reasonable water conservation, it doesn't induce growth, and the water from land retirement will be put to reasonable and beneficial uses.
5. Study local community impacts and other third party impacts and develop and implement the necessary actions for maintaining the economic stability of local communities and mitigation of socioeconomic impacts.
6. Study regional impacts resulting from land retirement including impacts from reduced agricultural production inputs and reduced farm income, income received from land payments and habitat restoration.
7. Land retirement must comply with the CEQA. The land retirement programs must include fair treatment of people of all races, cultures and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

Rainfed Agriculture

Rainfed agriculture is when all crop consumptive water use is provided directly by rainfall on a real time basis. Due to unpredictability of rainfall frequency, duration, and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture. This is especially true in California, where there is little or no precipitation during most of the spring and summer growing season.

Current Extent of Rainfed Agriculture in California

Climatic conditions in California provide excellent conditions for crop production; little cloud cover provides ample solar radiation during the spring and summer growing season. Precipitation in the form of rainfall and snow occurs mainly during the fall and winter months. However, the lack of sufficient and timely rainfall during the spring and summer in much of California severely limits the potential for expansion of rainfed agriculture.

In California's interior, north coast, and central coast, winter crops directly use rain water with the help of more irrigation water during the latter part of the winter season, if needed. These areas provide a relatively high return from the high value winter crops such as vegetables in the coastal areas. Other important agricultural production sectors that are dependent on rainfall are pastoral areas, rangelands, and rolling hills in the state. These areas produce significant amounts of feed and provide grazing areas for the state's large cattle (dairy and meat) industry. Winter small grains crops, such as winter wheat, account for about 4 percent (400,000 acres) of agricultural lands and provide a relatively small contribution to the state's total agricultural economy.

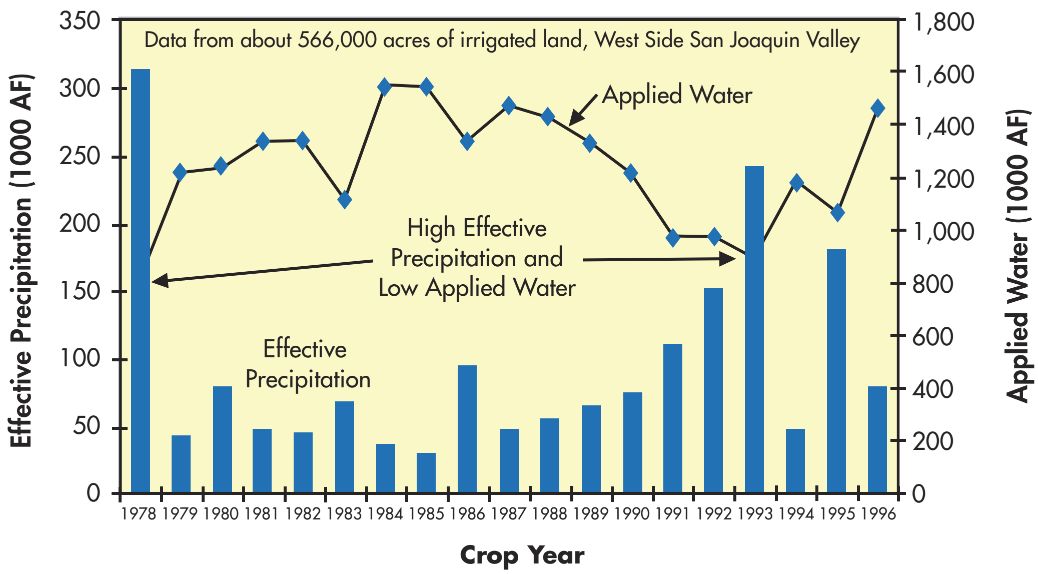
The vast majority of California's agricultural production requires irrigation. Rainfall that occurs before irrigation season and during the irrigation season can reduce irrigation water requirements. During years with heavy springtime rains, soil moisture remains higher for longer periods of time and can measurably reduce irrigation requirements for the year. Growers and water districts factor effective rainfall into their water management practices. In addition, DWR's water balance calculations for each region account for the portion of crop water requirements provided directly by rainfall.

As demonstrated in Figure 26-1, applied water and rainfall events are closely related. More rainfall, particularly during early growing season, provides a significant quantity of effective rainfall for crop consumptive use. The figure shows the inverse relationships between effective rainfall and applied water. Based on the 18 years (1978-1996) of data for an area on the west side San Joaquin Valley, effective rainfall provided an average of 7 percent of the total crop consumptive use. In 1978 and 1993, two wet years with early season rainfall, effective rainfall amounted to 27 and 21 percent respectively of the crop consumptive use. In 1990, a dry year, effective rainfall amounted to only 3 percent of the total crop consumptive use. Similar examples can be given for other regions of the state.

Potential Benefits

Currently, improvements in the rainfed agricultural production offer limited water supply opportunity in California. More acreage for production of winter crops will reduce runoff flowing in the surface water systems and to ocean outflows. Improvements in rangelands and grazing areas through improved plant varieties can provide crop yield benefits but not significant water supply opportunities. One important aspect of improved rainfed agriculture is a better post harvest/pre-planting soil management for winter crops such as wheat. Many winter wheat growers are already implementing adequate and prudent soil management practices for water and erosion manage-

Figure 26-1 Effective precipitation and applied water



ment. Land that is tilled and left fallow after harvest can cause the soil surface to seal with the first and second rainfall and increase runoff and erosion. Improved tillage practices, no-till or minimum-till, may improve water infiltration into soil root zone, thus increasing soil-water storage and could contribute to water supply by eliminating the first seasonal irrigation. Additionally, increased soil moisture reduces soil erosion; helps improve water quality and may help increase water use efficiency and economic efficiency. Advances in plant genetics to provide higher crop yields from direct rainfall could replace some crops that rely on irrigation.

Quantification of potential water savings from improved rainfed agriculture, while very small, is not possible due to lack of information.

Potential Costs

Potential cost consists of on-farm soil management and cost of research and development, demonstration and educational and training and dissemination of information and technologies. On-farm cost is an integral part of soil management that is already part of grower's practices. Soil management practices may need to be adjusted for timing with no additional or minimal cost. Cost of research, development, demonstration, education, and training and dissemination of new information and tillage management technologies will need to be paid by the State. It is possible that such activities can be funded from CALFED Water Use Efficiency loans and grants.

Major Issues Facing Additional Rainfed Agriculture

While rainfed agriculture provides some opportunity for increasing yield and water supply reliability, the efforts will likely result in insignificant and unquantifiable contributions to the water supply. However, increases in yields for winter crops and winter cover crops can be significant and benefit overall water management in California. Water supply Improvements would require development of new varieties of plants, new and innovative soil and water management. A major issue is that quantification of water savings cannot be made at the present time. Also, this strategy does not provide water supply benefits on a real time basis. For example, improvements in soil management may provide future benefit in storing more rainfall in the root zone if future uncertain and unpredictable weather conditions prevail.

Recommendations to Increase Water Use Efficiency in Rainfed Agriculture

Following is a list of recommendations to increase water use efficiency in the rainfed agriculture:

1. Develop improved varieties of winter rainfed crops, such as wheat, other small grains, cover crops, and winter crops. This can be achieved by providing financial resources to the state's research and development institutions to develop new and improved varieties. In addition, develop research and demonstration of innovative water management

practices where growers with marginal lands and marginal production may shift from irrigated agricultures to rainfed winter crops.

2. Provide technical and financial assistance to promote no-till or minimum-till practices by growers who prepare their lands for planting during spring, but leave it fallow during the fall and winter. Cooperative efforts with the state's research and development institutions can benefit this important aspect of rainfed agriculture.
3. Develop new and innovative technologies, management, and efficient water management practices for rainfed agriculture, particularly winter wheat.
4. Provide technical and financial assistance to implement technologies, and management practices for rainfed agriculture.
5. Develop and promote new and innovative activities and management practices for intensive and managed grazing.
6. Maximize, collect, and store runoff from rainfed agriculture and develop cooperative efforts to link runoff from rainfed agriculture and water banking and conjunctive use activities and groundwater recharge.
7. Disseminate practical information through educational and training opportunities.

Waterbag Transport/Storage Technology

The use of waterbag transport/storage technology involves diverting water in areas that have unallocated fresh water supplies, storing the water in large inflatable bladders, and towing to an alternate coastal region. Fresh water is lighter than seawater, which makes the bags float on the surface. This makes them easier to tow. After discharging their contents, empty bags are then reeled to the deck of the tug allowing for a more speedy return to the source water area.

Use of Waterbag Transport/ Storage Technology

Although this strategy is not currently being used in California, there have been several proposals to implement this technology throughout the world. The most recent was the proposal by Alaska Water Exports Company to divert up to 30,000 acre-feet from the Albion and Gualala River Rivers in Northern California and transport the water to the San Diego metropolitan area. The proposal received significant local opposition in Northern California.

Potential Benefits

- Provide water supply benefit
- Improve drought preparedness
- Improve water quality
- Operational flex and efficiency
- Environmental benefits
- Energy benefits
- Reduce groundwater overdraft

Potential Costs

The total cost for waterbag transport is highly project specific and contingent upon several factors such as facility costs for diverting and off-loading water, environmental mitigation, administrative costs, cost to construct bags, and towing costs.

Issues Facing Waterbag Transport/ Storage Technology

Third-Party Impacts — Similar to any other type of transfer, impacts on the area of origin may occur. This includes projects that use "surplus" water and using water that is currently being put to a beneficial use. Other issues of concern expressed to proponents of recent projects include aesthetics and noise pollution from diversion facilities and the dissatisfaction within area of origin communities that others are exporting a local resource.

Environmental Impacts — Although most proposed diversions for waterbag transport take place near the mouth of a source river, facilities may need to be built to convey the water from a significant distance upstream (e.g. before blending with high salinity ocean water). Some areas may already have conveyance facilities in place that could be accessed for waterbag storage and transport.

Selected References

Crop Idling for Water Transfers

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Palo Verde Irrigation District Land Management Program: www.mwdh2o.com/mwdh2o/pages/yourwater/supply/paloverde01.html

Dewvaporation or Atmospheric Pressure Desalination

Beckman, James. R., Arizona State University, Tempe, Arizona, and U.S. Bureau of Reclamation. "Carrier Gas Enhanced Atmospheric Pressure Desalination." Final Report. October 2002.

Fog Collection

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Irrigated Land Retirement

WWD Land Retirement Program: www.westlandswater.org/drainage/drainage1.htm

Land Retirement Guidelines, USBR, www.mp.usbr.gov/cvpia/lrgdln97.pdf

The San Joaquin Valley Drainage Program 1990 Report (the Rainbow Report) and other reports: www.owue.water.ca.gov/statedrain/pubs/pubs.cfm

The San Joaquin Valley Drainage Implementation Program www.owue.water.ca.gov/statedrain/index.cfm

The Land Retirement Report- SJVDIP

The USBR San Luis Drainage Feature Reevaluation and EIS www.mp.usbr.gov/sccao/sld/index.html

Drainage Without a Drain. The Bay Institute et al. www.bay.org

Rainfed Agriculture

Local agencies (reports and publications)

Local farm advisors and UC System

Federal Bureau of Land Management and National Forest Service

Private rangeland owners and relevant associations of rangeland managers/owners

United States Department of Agriculture, ARS State educational institutions (Fresno CIT, Cal Poly, etc.)

Published technical and scientific papers

California Cattlemen Association

Commodity groups

Ranches

Information from best professional/scientific assessment/ judgment of DWR's staff and others

Waterbag Transport/Storage Technology

Wang, Ucilia. "Plan to export Gualala, Albion water to Southern California drew heat on North Coast". Santa Rosa Press Democrat. December 14, 2002.